

DRAKONOCHORISTIDAE FAM. NOV., A NEW MIDTRIASSIC FAMILY OF MECOPTERA FROM CHINA (INSECTA, MECOPTERA)

HONG You-Chong

Beijing Museum of Natural History, Beijing 100050, China; E-mail: hongyouchong@yahoo.com.cn.

Abstract A new family Drakonochoristidae fam. nov. is described to include a new subfamily Drakonochoristinae and the subfamily Pseudoannochoristinae Novokshonov, 1994. The new subfamily with two new genera and species were collected from the Middle Triassic Tongchuan Formation of the Tongchuan Region, Shaanxi Province, China. The characters of the new family and its taxonomic position are discussed. The discovery of the new family has yielded certain reference values, especially for the study on the evolutionary relationship between the Permochoristidae and Nannochoristidae.

Key words Drakonochoristidae fam. nov., *Drakonochorista* gen. nov., *Yangochorista* gen. nov., Midtriassic, Tongchuan Formation, Shaanxi.

The fossil insects of the Permochoristidae and the Nannochoristidae have been studied previously by Bode (1953), Carpenter (1992), Guo *et al.* (2003), Handlirsch (1906 – 1908), Hong (1998, 2005), Hong *et al.* (2002), Kukalova- and Willmann (1990), Martynova (1959, 1962), Novokshonov (1997a, b, 1998), Novokshonov and Sukatcheva (2001), Riek (1953, 1967, 1968), Sukatcheva I (1990), Tillyard (1933), and Willmann (1984, 1987, 1989). These references, especially Novokshonov's articles (1994, Paleont. J., 6: 65 – 76 and 1997, Perm University Geology, 4: 126 – 136) have great help for the establishment of the new family Drakonochoristidae fam. nov.

The fossil specimens were collected from the Middle Triassic Tongchuan Formation (Tr_{2t}) from the Jingsuoguan to Hejiafang Villages of the Northwest Tongchuan City, Northern Xi'an City of the Shaanxi Province China. Based the specimens, a new family (Drakonochoristidae fam. nov.) with a new subfamily (Drakonochoristinae subfam. nov.), two new genera and species (*Drakonochorista longovata* gen. et sp. nov. and *Yangochorista hejiafangensis* gen. et sp. nov.) are established and reported here.

The main features of this new family annexed to both features of the Permochoristidae in the MP with 6 branches and of the Nannochoristidae in the Rs + MA with 3 branches, and formed a unique and new intermediate group between the Permochoristidae and Nannochoristidae. The discovery of the new family and its new genera and species fill vacancy in the mecopteran field of China and can be helpful us to trace the mecopteran evolution, especially to the study on the evolutionary relationship between the Permochoristidae and Nannochoristidae.

The holotypes are deposited in the Beijing Museum of Natural History.

1 Systematic Description

Insecta Linne, 1758

Eumecoptera Tillyard, 1933

Mecoptera Parkard, 1886

Drakonochoristidae fam. nov.

Genotype. *Drakonochorista* gen. nov.; Tongchuan Region of Shaanxi Province, China; Middle Triassic (Tr_2), Tongchuan Formation (Tr_{2t}).

Etymology. Consisting of the drakon-chinese myth and an old family Choristidae.

Diagnosis. forewing, the costal area broader than that of subcostal; extended beyond midwing; Sc with a twig; R single, Rs + MA with 3 branches, among them Rs single or with two branches; MA with two branches or single; MP with 6 – 5 branches. However, Rs + MA with 3 branches, as for Nannochoristidae; MP with 5 – 6 terminal branches, as for Permochoristidae; and then coalesced directly with CuA.

Characters. the main characters of the new family annexed to both features of the Rs + MA with 3 branches (as for Nannochoristidae) and the MP with 6 branches (as for Permochoristidae), and formed a unique new intermediate group between the Nannochoristidae and Permochoristidae.

Distribution. Shaanxi Province of China (Tr_2); Kuznechk basin of Russian (P_2).

Composition. The new family includes two subfamilies: Drakonochoristinae subfam. nov. and Pseudonannochoristinae. Novokshonov, 1994.

Taxonomic position. According to the venational features, the Drakonochoristinae subfam. nov. and

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Pseudonannochoristinae Novokshonov, 1994 have common features, such as Rs + MA with 3 branches, MP with 6 – 5 terminal branches. They should be referred commonly to the new family Drakonochoristidae.

Drakonochoristidae fam. nov. includes two subfamilies: Drakonochoristinae subfam. nov. (Genotype and type species: *Drakonochorista longovata* gen. et sp. nov.) (Tr_2) and Pseudoannochoristinae Novokshonov, 1994. (Genotype and type species: *Pseudonannochorista willmanni* Novokshonov, 1994) (P_2) (see in V. G. Novokshonov, 1994, Paleont. J., 1: 65 – 76). Although they have common features in the venation, But the main features of two subfamilies are still differently and can be summarized in “Key to subfamilies”.

Key to subfamilies.

- 1 (2) Costal area broader conspicuously than that of subcostal or equal to subcostal; Rs single or with 2 branches; MA with 2 branches or single; AMP with 4 branches (forking dichotomously or pectinate-like) and PMP with 2 branches **Drakonochoristinae subfam. nov.**
- 2 (1) Costal area narrower than that of subcostal; Sc with a twig; terminal part of the R straight; Rs single; MA with 2 branches; MP with 5 branches; AMP with 3 branches, PMP with 2 branches **Pseudoannochoristinae Novokshonov, 1994**
(The descriptions of this subfamily see in V. G. Novokshonov's original 1994, paper)

Drakonochoristinae subfam. nov.

Genotype. *Drakonochorista* gen. nov.

Diagnosis. Forewing, costal area broader conspicuously than that of subcostal or equal to subcostal; Rs single or with 2 branches; MA with 2 branches or single; AMP with 4 branches (forking dichotomously or pectinate-like) and PMP with 2 branches.

Distribution. See in “Distribution of family”.

Composition. The different feature of two new genera see in “Key to genus”.

Key to genera.

- 1 (3) Rs single; MA with 2 branches
- 2 (4) Rs with 2 branches; MA single
- 3 (5) AMP with 4 dichotomous branches
- 4 (6) AMP with 4 pectinate-like short branches
- 5 Having a oblique crossvein-amp-pmp and formed a median-cell- (mc) **Drakonochorista gen. nov.**
- 6 -amp-pmp without **Yangochorista gen. nov.**

Drakonochorista gen. nov.

Etymology. See in “Etymology” of the family.

Type species. *Drakonochorista longovata* sp. nov.

Diagnosis. Forewing; Rs single; MA with 2 branches; AMP with 4 dichotomous branches, PMP with 2 long branches; CuP closed to CuA.

Distribution. Middle Triassic (Tr_2); Shaanxi Province, China.

The new genus is closed to *Yangochorista* gen. nov., but their differential features see in the “Keys to genera”.

The new genus differs from *Pseudochorista* Novokshonov, 1994 in AMP with 4 dichotomous terminal branches, but in the latter AMP only with 3 branches.

Drakonochorista longovata sp. nov. (Figs 1 – 2)

Holotype: 82TH3-1/T067.

Etymology. From the Latin longa-long and ovata-egg-like.

Materials. One forewing specimen, except anal preserved incompletely, other part of the wing well-preserved and veins distinct.

Description. Forewing egg-like in shape; the costal margin arched apparently; the costal area wider conspicuously than that of subcostal; Sc single, without twig, running just midwing; the R single, extended beyond midwing and its termination curved apparently in the wing margin; merged vein of Rs + MA bent, then both separated each other, Rs single, stem MA very longer about twice than that of merged vein of Rs + MA; MA forked in a little before the R ending, and with 2 branches; MA_{1+2} and MA_{3+4} , common stem MA_{3+4} equal almost to that of MA in length, but longer than about twice merged vein Rs + MA; MP with 6 branches, and forked into AMP and PMP, then they forked respectively once again and formed 4 dichotomous branches; PMP forked into 2 branches; all branches very long; stem PMP longer in 3 times than that of AMP; the main stem MP long, arched and coalesced directly with the CuA near wing base; CuA and CuP curved apparently; anal vein preserved incompletely; the wingface clothed with the dark and light brown colours and 2 crossvein: r-m and amp-pmp.

Measurements. Forewing length 4.5 mm, wide 2.1 mm.

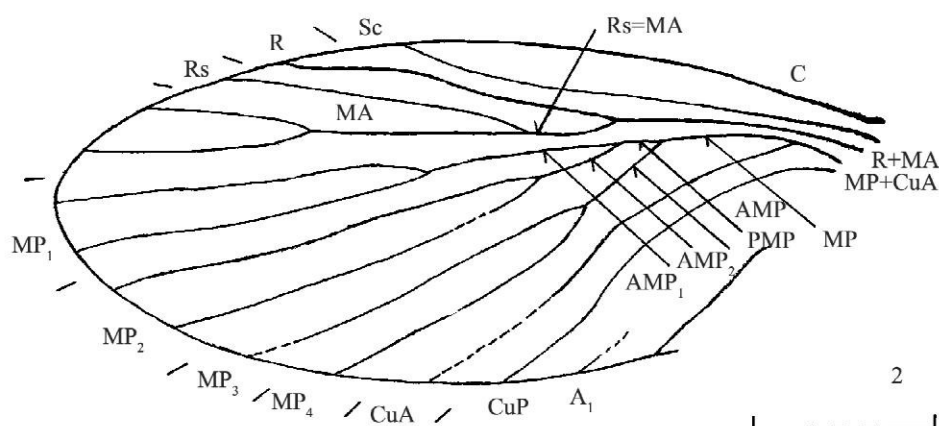
Locality and Horizon: Tongchuan Region of Shaanxi, China; the specimen is collected from the grayish-green mudstone and shale of the first fossil bed, Upper part of the Lower Member, Middle Triassic Tongchuan Formation (Tr_{2i}), corresponded to European Ladinian.

Yangochorista gen. nov.

Etymology. The name of the genus is named in honor Prof. and Member of Academia Sinica, famous Stratigrapher-Paleontologist, my teacher YANG Zun-Yi (Ph. D. Yale) and an old genus Chorista.

Type species: *Yangochorista hejiafangensis* sp. nov.

Diagnosis. Forewing long; costal area equal somewhat to subcostal; Sc forked beyond midwing, with a twig; R single, Rs with 2 branches; MA single; AMP with 4 short terminal branches, forked in comb-like; PMP with 2 terminal branches; crossvein and mc without.



Figs 1 - 2. *Drakonochorista longovata* sp. nov., holotype 82TH3-1/T067. 1. Fossil photo of the forewing. 2. Character of venation. C-Costa; Sc-Subcosta; R-Radius; Rs- Radiosector; MA. MP-anterior and posterior branch of Media; Rs + MA-merged vein of Radiosector and anterior branches of Media; R + MA-merged vein of Radius and anterior branch; AMA, PMA-anterior and posterior branches of anterior branch of Media; AMP, PMP-anterior and posterior branches of the posterior branch of media; MP + CuA-merged vein of posterior branch of Media and anterior branch of Cubitus; CuA, CuP-anterior and posterior branches of Cubitus; A₁, A₂. -1st and 2nd anal veins. Scale bar = 1 mm.

Distribution. Middle Triassic (Tr₂); Shaanxi Province, China.

Comparison. The new genus differs from *Drakonochorista* gen. nov. in Rs with 2 branches, MA single; AMP with 4 long or short branches, forked in comb-like; PMP with 2 long branches, other different features see in the "Key to genera".

***Yangochorista hejiafanensis* sp. nov.** (Figs 3 - 4)

Holotype: 82TH3-2/T023.

Etymology. From fossil locality-Hejiafang Village.

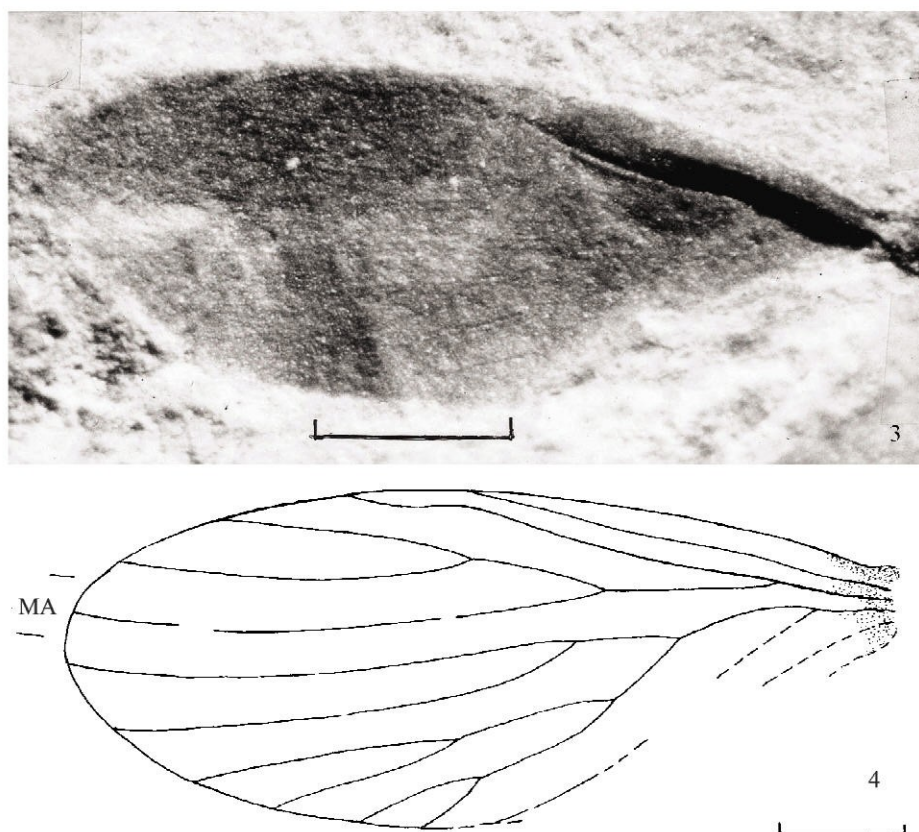
Materials. Forewing, anal area and the anal margin damaged, CuP and A₁ preserved incompletely, but the wing venation distinct.

Description. Forewing long, the costal margin arched widely, but its anterior part more or less straight and inclined towards basally; costal area equal

somewhat to subcostal; Sc extended beyond midwing; R curved, especially in its terminal part and extended beyond midwing; merged vein of Rs + MA arising early from R, with 3 branches, then the both separated; Rs with 2 branches, MA single; the MP with 6 terminal branches, among them AMP with 4 long or short branches, forked in comb-like; PMP with 2 long terminal branches, all terminal branches almost parallel, stem MP₁₊₂ forked in a little later than MP₃₊₄; main stem of MP coalesced with the CuA for a distance basally; the base of CuP remonte from CuA, but its terminal part closed apparently to it; MP + Cu extended gently and straightly to wing base.

Measurements. Forewing 6.5 mm long, wide 2.7 mm.

Locality and Horizon. Ditto, but the specimens of this species are collected from Second fossil bed.



Figs 3 – 4. *Yangochorista hejiafangensis* sp. nov., holotype 82TH3-2/T023. 3. Fossil photo of the forewing. 4. Venational characters.

2 Featural Comparison and Taxonomic Discussion

The new family is similar to Permochoristidae and Nannochoristidae, but differs from them in following features.

2.1 Compared with Permochoristidae Tillyard, 1917

Except the MP with 6 branches of the new family is the same as Permochoristidae, but the *r* features of the forewing venation differ obviously from Permochoristidae as follows.

1) Costal area of the new family wider than that of subcostal; in the latter the costal area narrower than subcostal.

2) *Rs* + *MA* of the new family with 3 branches; in the latter the *Rs* + *MA* forked dichotomously into 4 branches.

3) MP of the new family coalesced directly with the *CuA*; in the latter the MP commonly not coalesced directly with the *CuA*, while MP connected to the *CuA* by a crossvein *m-cu*.

4) Although the *R* of the new family unbranched, being same as Permochoristidae, but *R* of the latter can be forked into 1 – 3 twigs, such as *Agetochorista* Martynov, 1933, *Liassochorista* Tillyard, 1933. Besides, other features of two families can be distinguished to each other. So the new family can not refer to Permochoristidae.

2.2 Compared with Nannochoristidae Tillyard, 1917

Although *Rs* + *MA* of the new family with 3 branches is the same as Nannochoristidae, but differs from it in the costal area wider than the subcostal, MP with 6 branches. Thus the new family can be distinguished from it, because in the latter the costal area narrower than the subcostal, *Sc* with 1 – 3 twig and the MP only with 3 – 4 terminal branches. The above different features of the MP between the Nannochoristidae and Drakonochoristidae indicated that they existed respectively obviously different venational structure. So the new family can not refer to Nannochoristidae.

Judge from the results of above featural comparison, the wing venation of the new family not only appeared more simplified and advanced features such as Nannochoristidae (including Pseudoannochoristinae Novokshonov, 1994), as *Rs* + *MA* at more with 3 branches and MP coalesced directly with *CuA* for a distance basally, but also remained archaic venational features such as the MP with 6 branches of Permochoristidae. Thus, the new family formed a new unique intermediate group between the Permochoristidae and Nannochoristidae.

Thus it can be seen that the new family not only can not refer to Permochoristidae, but also not to Nannochoristidae. According to the special venational

features of the new family, it should have itself taxonomic position. So it is appropriated that a new family Drakonochoristidae is erected.

2.3 The evolutionary relationship of the

Drakonochoristidae fam. nov.,

Nannochoristidae and Permochoristidae in the geological background

From the geological background and geological age the family Permochoristidae appeared from the late Paleozoic era (P) to Jurassic (J) [may be to early Cretaceous (K₁)] of Mesozoic era; the family Nannochoristidae presented from late Paleozoic to recent (P-R); the Drakonochoristidae fam. nov. has emerged in the late Paleozoic era (P), and only firstly discovered from Mesozoic Midtriassic. Thus it can be seen that the evolutionary course in the geological background of above three families are differently.

From the venationary feature, the new family is annexed permochoristid some archaic venational features, such as the MP with 6 branches and Nannochoristid more simplified and advanced features, such as Rs + MA only with 3 branches, thus the new family formed a new unique intermedian group between Permochoristidae and Nannochoristidae.

It can be seen that they have not only common features, but also obvious different features, and formed respectively unique different group in the geological background and conform to the insect evolutionary laws in various geological course. So the discovery of the new family has yielded certain reference values, especially for the study on the evolutionary relationship between Permochoristidae and Nannochoristidae.

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中国中三叠世龙蝎蛉新科的发现（昆虫纲，长翅目）

洪友崇

北京自然博物馆 北京 100050; E-mail: hongyouchong@yahoo.com.cn

摘 要 记述龙蝎蛉新科 *Drakonochoristidae* fam. nov. 和 1 新亚科及其 2 新属、种和 1 个老亚科。2 新属种的化石标本采自中国陕西铜川中三叠统铜川组下段上部的灰绿色泥岩和页岩。新科性质及其分类位置在文中进行讨论。新科的建立填补这个类群在中国的空白，同时对于小蝎蛉科

Nannochoristidae 和二叠蝎蛉科 *Permochoristidae* 的演化关系的研究有一定的意义。这些新属、种系陕西昆虫群（陕西生物群的一个类别）铜川昆虫组合的新成员。铜川组的时代相当于欧洲拉丁尼期（Ladinian Stage）。

关键词 龙蝎蛉科，龙蝎蛉属，杨氏蝎蛉属，中三叠世，铜川组（ T_{2t} ），陕西。

中图分类号 Q915.819.7